

How rapid was a dramatic atmospheric circulation change in Central-East Europe 22 ka ago caused by the advance of Scandinavian Ice Sheet?

Jerzy Nawrocki¹, Olga Rosowiecka², Tomasz Werner³

¹Faculty of Earth Sciences and Spatial Management, Maria Curie-Skłodowska University in Lublin, Kraśnicka 2cd, 20-718, Lublin, Poland. e-mail: jerzy.nawrocki@pgi.gov.pl

²Polish Geological Institute – National Research Institute, Rakowiecka 4, 00-975 Warszawa, Poland

³Department of Magnetism, Institute of Geophysics, Polish Academy of Sciences, Księcia Janusza 64, 01-452 Warszawa, Poland.

The impact of climate change on the biotic environment is widely recognized as being influenced not only by the magnitude of variations in fundamental parameters such as temperature and humidity but also by the speed of these changes. This speed determines whether individual species or entire ecosystems have the time to adapt. Periglacial loess sequences represent one of the best onshore climate archives. However, these sequences are primarily dated in their younger parts using the optically stimulated luminescence (OSL) method. The OSL, as well as infrared (post-IR IRSL) and blue light stimulated luminescence methods applied to Last Glacial Maximum loess from Poland, have produced, however, age estimates with large errors ranging from ± 1.1 ka to ± 2.2 ka. To create high-resolution time frames for two MIS2 loess sections in Central-Eastern Europe, the palaeosecular variation (PSV) of geomagnetic field curves were elaborated and correlated with existing data from marine and lake sediments dated by ^{14}C method. The regional stratigraphic correlation of PSV enabled the construction of these time frames, benefiting from a more accurate geochronology and continuous sedimentation in water sediments compared to those in the loess. Previous research on the anisotropy of magnetic susceptibility in the loess of Central-Eastern Europe revealed a rapid transition from southern to northern katabatic winds approximately 22 ka ago, coinciding with the advance of the Scandinavian Ice Sheet. At the site, which is separated from the glacier foreland by a morphological ridge and located roughly 300 km from the ice sheet front, this change occurred within a span of no more than 30 years. In an open area, not surrounded by significant elevations, the onset of northern katabatic winds was preceded by a phase of intermediate winds that followed the southern winds, lasting about 100 years. The beginning of the southern winds aligns well with the end of Heinrich Stadial 2 (c. 23.4 ka).